(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 0 722 792 A1

(12) **EUROPEAN PATENT APPLICATION**
published in accordance with Art. 158(3) EPC

(43) Date of publication:
24.07.1996 Bulletin 1996/30

(21) Application number: **93919689.5**

(22) Date of filing: **20.09.1993**

(51) Int. Cl.[6]: **B21D 35/00**, B21D 28/02, B21D 19/00

(86) International application number:
PCT/JP93/01348

(87) International publication number:
WO 95/08411 (30.03.1995 Gazette 1995/14)

(84) Designated Contracting States:
DE FR GB

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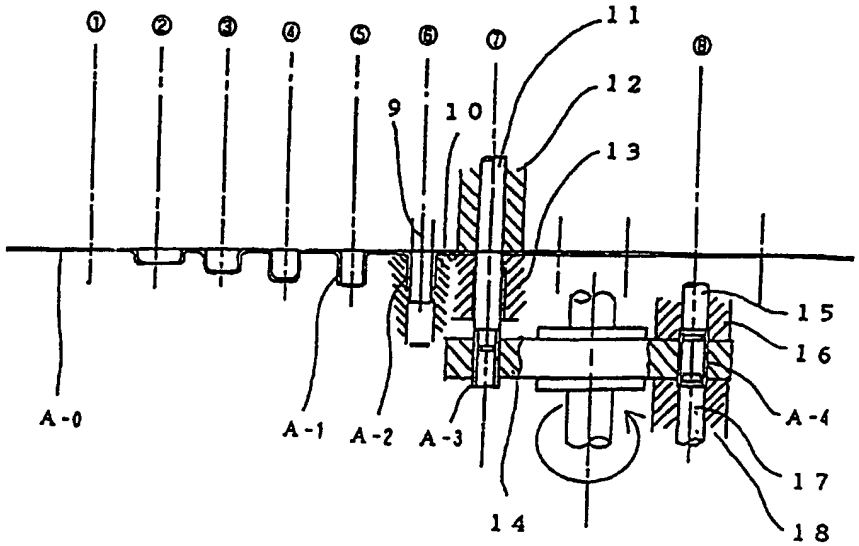
(54) METHOD OF SEQUENTIALLY MANUFACTURING HOLLOW KNOCK PINS

(57) To reduce the man-day in the pressing of hollow knock pins. The method comprises the steps of deep-drawing a plate material A-0 to shape the material into a predetermined shape A-1, ironing the resultant work at a low draft, punching the bottom portion in the same die by the same ironing punch (9), punching a flange portion to shape the work into a cylinder A-3, and compression-molding both end surfaces and outer circumferential portion into cone, by molds (15, 16, 17, 18). The steps are sequentially carried out.

Fig. 1



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Description

[Detailed Description of the Invention]

[Field of Industrial Application]

This invention relates to a positioning component having a structure for assembling components with one another and equipped with a function of penetrating a bolt or connecting fluid passages.

[Prior Art]

Knock pins includes a hollow knock pin capable of penetrating a bolt for fixing components with one another or connecting fluid passages between the components. A method of manufacturing this hollow knock pin involves the steps of expanding a pipe material into a predetermined size by expansion machining, cutting this material into a predetermined length, chamfering both end faces of the material as well as its conical face on the outer peripheral end face and further polishing cylindrically the outer peripheral portion.

[Problem to be Solved by the Invention]

In this machining process, the pipe expansion step, the end face machining step and the cylindrical polishing step provide individual machining steps due to the properties of a machining equipment. Therefore, works-in-process must be kept during these steps, appurtenant jobs are necessary for the cutting step and the end face machining step due to the occurrence of chips, and a ratio of the net machining time is low in the cutting step. For these reasons, there remains the limit to improving production efficiency.

[Means for Solving the Problems]

To solve the problems described above, the present invention provides means which deep-draws a plate material into a predetermined shape, cylindrically punches the bottom portion and the flange portion, and shapes both end faces by molds into a predetermined shape, and means which constitutes a series of machining steps from the drawing step to the shaping step of the end face portion in a sequential type and enables continuous machining by a plate material.

[Function]

The volume of the end face portion obtained by deep-drawing a plate material and punching its corner portion in a restrained state can be approximated to the volume of both end face portions of a knock pin. Therefore, the shape of the end face portion can be easily compression-molded by the molds. In other words, the sequential process can be accomplished by the combination of the shape characteristics of the corner portion obtained by deep-drawing the plate material with the punching system.

[Embodiment]

Hereinafter, an embodiment of the present invention will be explained with reference to the accompanying drawings. Fig. 1 is the sequential machining steps according to the present invention and a relational diagram of punching of the bottom portion after ironing, punching of the flange and compression molding of both end faces. Fig. 2 shows the appearance of the product obtained by the manufacturing method of the present invention, Fig. 3 is a sectional view at the time of punching of the bottom portion after ironing, Fig. 4 is a sectional view at the time of punching the flange, Fig. 5 is a view showing the shape of the component after punching of the flange shown in Fig. 4, and Fig. 6 is a sectional view at the time of compression molding.

Numerals (1) to (8) in Fig. 1 represent the process steps, and symbols A-1 to A-4 represent the change of the shape with the machining steps. The steps ranging from (1) to (5) are a general deep drawing step, the step (6) punches the bottom portion inside the same mold after ironing, and at the step (7), the work is inserted into a holder 14 disposed at a lower portion after punching of the flange portion. This holder 14 has an index system so that the process steps can be reversed and both end faces can be compression-molded by an upper punch 15, a die 16, a lower punch 17 and a die 18 of the step (8). The sequential system of the present invention is characterized in that the index mechanism is assembled into the sequential mold so that after the deep drawing step, A-3 separated from the flange portion at the step (7) can be inserted into the holder 14 and then transferred to the next step.

The shape of the product shown in Fig. 2, which is obtained by the sequential process described above, is formed fully by plastic machining, and its outer appearance defines the plastic machining surface with the exception that the outer peripheral portion is cylinder-polished, whenever necessary. Accordingly, the faces corresponding to the conical surfaces of the outer peripheral portion at both ends particularly define a surface having a gentle surface of curvature, so that insertion into a fitting portion of a mating component can be easily made and the burrs do not occur at the time of press-in.

Fig. 3 shows the structure of the mold for ironing and punching the bottom portion at the step (6). Because the bottom portion, which is affected by uniforming of the thickness due to contraction of the diameter and

to ironing and by variance of the thickness, is punched to the outer diameter of a drawing punch 9, the volume corresponding to the production portion can be made uniform. The radius of the corner of the drawing portion 10-1 of the die 10 is set to be not greater than 1 mm, and the radius of the corner between the flange

portion and the cylindrical portion is reduced to the minimum. In the shape of the bottom portion punching die portion 10-2, a parallel portion is disposed at a cutting edge portion, and the outer peripheral portion is set to the shape of the outer periphery of the bottom portion A-1. Symbol A-2-1 represents slug.

Uniforming of the volume at the portion corresponding to the product portion of this process does not invite the occurrence of excess metal because shaping (8) of the later-appearing both end portions is made under the sealed state.

The A side in Fig. 3 shows the state immediately before ironing and the B side shows the state immediately after punching of the bottom portion.

Fig. 4 shows the structure of the punch mold of the flange at the step (7). Since the volume of the punch portion affects shaping of the end face, the punching structure under the sealed state is employed by utilizing the shape of the radius of the corner between the flange and the cylindrical portion. The outer diameter portion of the 11-1 portion of the punch 11 is the cutting edge and the shapes of the guide portion and the corner portion match the shape of the radius of the corner portion A-2. The cutting edge portion 13-1 of the die 13 has an acute angle. The flange portion A-2 is pressed to the die 13 by a keep plate immediately before punched by the punch 11, and punching is carried out under the restrained state.

The C side in Fig. 4 shows the state immediately before punching of the flange portion, and the D side shows the state immediately after punching.

The shape obtained by the method described above is shown in Fig. 5. Even when the flange portion is punched under the restrained state, the outer diameter of the portion A-3-2 corresponding to the fracture is greater by A-3-3 than A-3-4. Accordingly, even if the pin is fitted into the holder 14 shown in Fig. 1 after punching, it does not fall off. The inner peripheral portion corresponding to A-3-2 is greater than the inner peripheral portion of A-3-4.

Fig. 6 shows the structure of the molding die of both end faces at the step (8). The punches 15 and 17 and the dies 16 and 18 having the same shape, respectively, are respectively disposed above and below the holder 14, and the respective punches and dies are set in such a manner that when they come into close contact with the holder 14, both end portions are sealed. The outer diameters 15-1, 17-1 of the punches 15 and 17 is brought into conformity with the outer diameter of the ironing punch 9 in Fig. 3, and the outer diameter of the punches 15 and 17 is equal to the planar size of both end portions. The molding dies 16 and 18 are conical dies. The molding dies are set so that A-4 is not formed, by placing them to only the portion to be molded. The E side in Fig. 6 shows the state immediately before molding and the F side shows the molding state.

[Effect of the Invention]

As described above, the present invention reduces the number of the process steps by conducting ironing and punching of the bottom portion at the same step after deep drawing of the plate material and constitutes the insertion into the holder disposed on the index plate after punching of the flange portion and molding of both end faces into the sequential type. Accordingly, the present invention makes it possible to conduct press machining, can attain a multiple mold structure and can therefore improve production efficiency and machining economy.

[Brief Description of the Drawings]

[Fig. 1]

Fig. 1 is the sequence of the sequential manufacturing steps and a relational diagram of the compression molding step of punching of the bottom portion after ironing, punching of the flange and the compression molding step of both end faces.

[Fig. 2]

Fig. 2 is an appearance view of the product obtained by the manufacturing method of the present invention.

[Fig. 3]

Fig. 3 is a sectional view at the time of punching of the bottom portion after ironing.

[Fig. 4]

Fig. 4 is a sectional view at the time of punching of the flange.

[Fig. 5]

Fig. 5 is a view showing the shape of the product after punching of the flange.

[Fig. 6]

Fig. 6 is a sectional view when both end portions are compression-molded.

[Explanation of Reference Numerals]

(1) to (8) ...
sequence of machining steps
A-0 to A-4 ...
shapes of component with sequence of machining steps
A-2-1 ...
slug

A-3-1 ...
flange scrap
9, 11, 15, 17 ...
punch
11-1, 15-1, 17-1 ...
punch portion
10, 13, 16, 18 ...
die
10-1, 10-2, 13-1, 16-1, 18-1 ...
die portion
12 ...
keep plate
14 ...
index plate

Claims

1. A manufacturing method characterized by sequentially carrying out the following steps by a press mold:

deep-drawing a plate material as a raw material into a predetermined shape;

ironing the material at a low draw ratio;

punching the bottom portion by the same ironing punch inside the same mold;

punching a flange portion into a cylindrical shape; and

compression-molding the end faces at both end portions and an outer peripheral portion into a conical shape by a mold.

2. A component having the shape of end faces at both end portions and the shape of a surface of curvature of the outer peripheral portion obtained by the manufacturing method described above.

Fig. 1

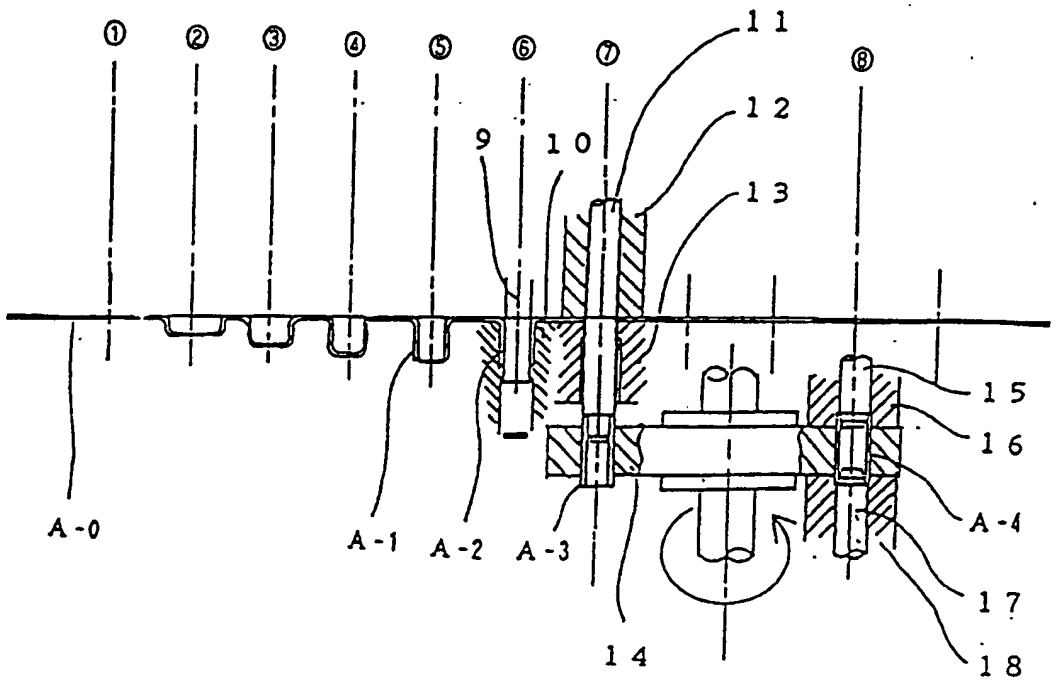


Fig. 2

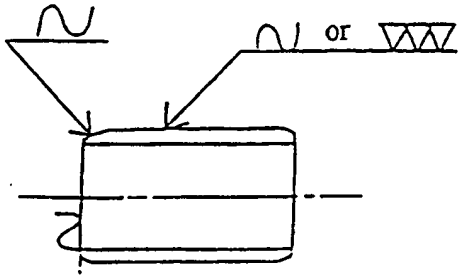


Fig. 3

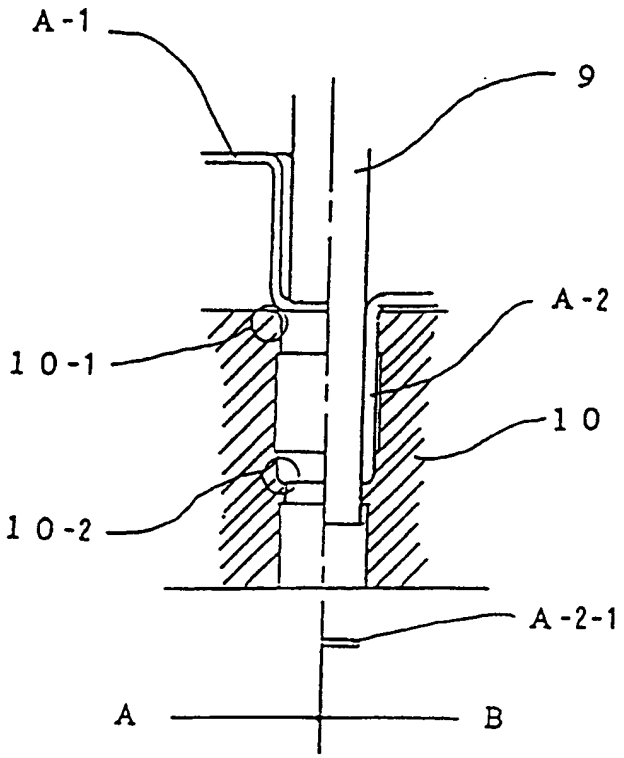


Fig. 4

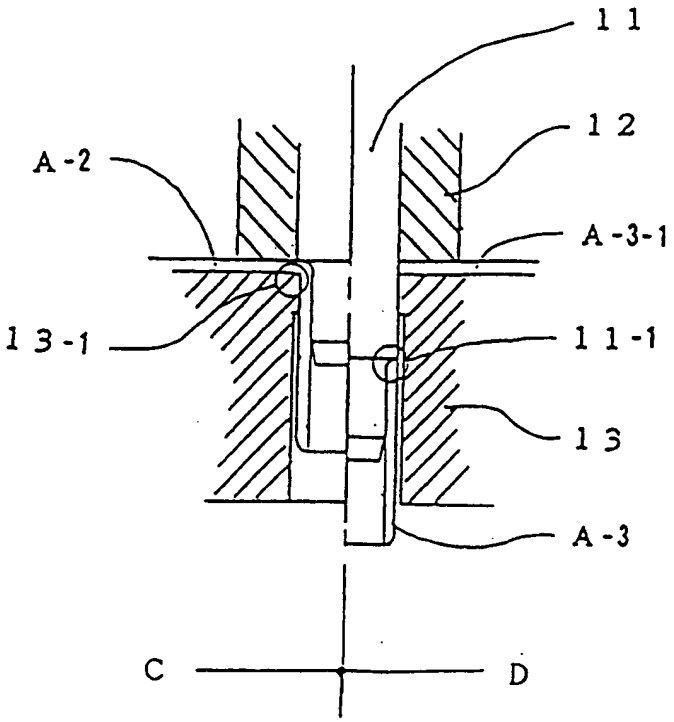


Fig. 5

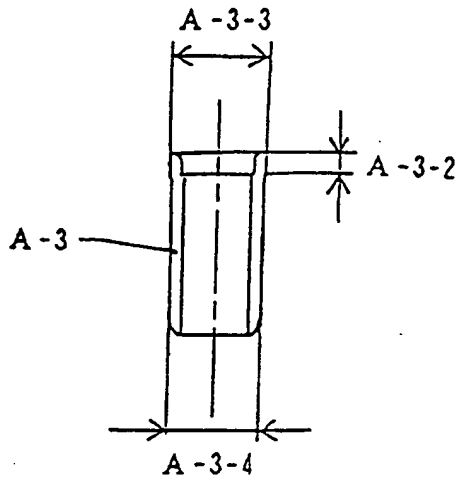
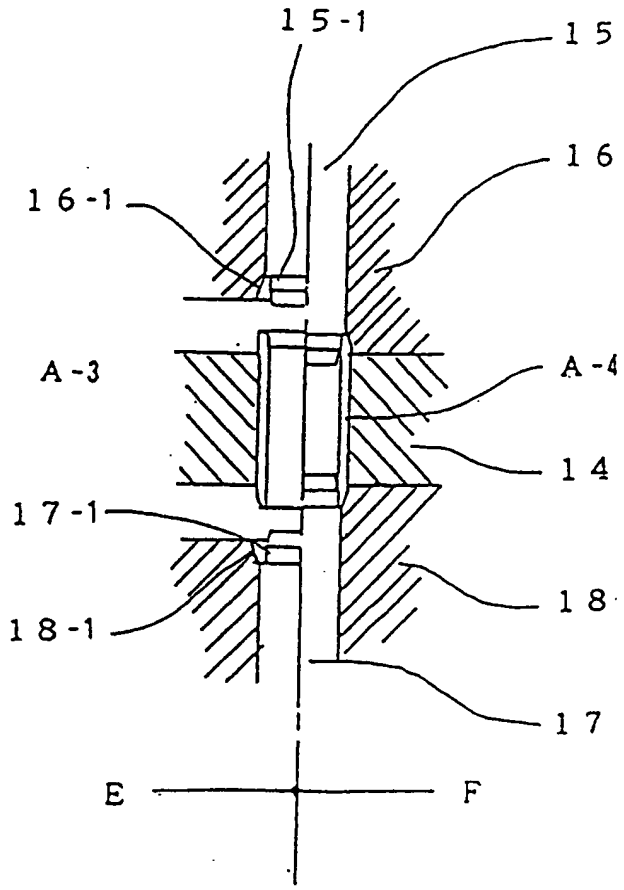


Fig. 6



INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP93/01348

A. CLASSIFICATION OF SUBJECT MATTER

Int. Cl^5 B21D35/00, B21D28/02, B21D19/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

Int. Cl^5 B21D35/00, B21D28/02, B21D19/00

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Jitsuyo Shinan Koho 1926 - 1993
Kokai Jitsuyo Shinan Koho 1971 - 1993

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X,Y	JP, A, 1-107923 (Nagata Buhin Seizo K.K.), April 25, 1989 (25. 04. 89), Claim, Figs. 7 to 8 (Family: none)	1, 2
A	JP, B, 56-26492 (Nagata Denshi Kogyo K.K.), June 18, 1981 (18. 06. 81), Claim, Figs. 3 to 6 & JP, A, 54-48673	1

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
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"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
December 1, 1993 (01. 12. 93)	December 21, 1993 (21. 12. 93)
Name and mailing address of the ISA/ Japanese Patent Office Facsimile No.	Authorized officer Telephone No.

Form PCT/ISA/210 (second sheet) (July 1992)